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EDITORIAL ETCHINGS.

During the last session of the state legislature a bill was passed authorizing the Board of Trustees of the Ohio State University to have a branch of the Consolidated Street Car Line of the city of Columbus run through the University grounds. It was thought that this would greatly enhance the convenience of getting to and from the University, and undoubtedly it would, but there are some objections to it. In the first place it would remove that character of privacy that has always existed in regard to the campus. In allowing the street cars to pass through, the grounds would be made more public and much of their charm will be lost. Again, it might be that the work in some departments would actually be interfed with by running an electric road near the buildings—the department of physics for instance—and for all of the departments the noise and disturbance caused by the moving cars would be more or less of a nuisance.

On the other hand there would be the greater convenience of getting to and from the University in bad weather. Undoubtedly some students are kept away from college altogether by reason of the difficulty of getting from the cars to the buildings in the wet and cold seasons of the year. It would undoubtedly help athletics, as the branch road was planned to run directly past the athletic park, and it would be a stroke in favor of entertainments and college affairs given at the University.

The Lantern, which has been the O. S. U. college paper for years, has started out this year in unusually good order, and the management is to be congratulated upon the excellent make-up of the paper. As is well understood, The Lantern is the newspaper of the Ohio State University, and as such presents accounts of all that transpires about college, and can be depended upon to furnish it straight, as the able corps of editors have each their department assigned to see to. Mr. C. F. Sprague still retains the business management, while the editorial department is under the able supervision of Mr. S. Andrew Roach. If the first regular issue is a fair sample, we can expect a model college paper for the coming year.

We have recently received the announcement of the New York State College of Forestry. The mere fact that such an institution has been established in this country demands our attention, since the cause is an important one and the needs of practical investigation in this subject are much more urgent than is generally supposed.

The New York College of Forestry was established by an act of the state legislature in April, 1898, which act authorizes the trustees of Cornell University "to create and establish a department in said University to be known as, and

called, the New York State College of Forestry, for the purpose of education and instruction in the principles and practices of scientific forestry." This same act also provides for a demonstration forest of 30,000 acres, to be laid off in the Adirondacks, and purchased by the forest preserve board, and to become the property of Cornell University for the term of thirty years.

From this short statement it is seen at once that the college is to be started upon a good foundation, and with the corps of instructors that has been provided, we can have no doubt that the instruction given and the investigations made will be of the highest order of merit.

Since forestry is practically an untried art in the United States, the entire subject must be taken up from the beginning, and it is to such institutions as this of which we are thinking, and to such men as Messrs. Fernow and Roth (the leaders in the movement) that we are to appeal for a successful forest policy for this country.

The consumption of wood materials in the United States, per annum, is estimated at something over 20,000,000,000 feet, and its value when prepared for use in the arts is estimated at not less than $1,000,000,000. Thus far, this great amount of wood has been supplied by the virgin forest resources of the country, but by the reckless consumption of our timber, and by careless waste through fires and reckless lumbering operations, these virgin supplies are reduced to a condition when attention to the future supply has become imperative.

At the last meeting of the American Association for the Advancement of Science at Boston, in August, Ohio and the Ohio State University scored a signal triumph. Beside taking a very active part in all the meetings of the association, the Ohio delegation was honored by having one of their number elected president of the association. Since this is the scientific body of America it is with sincere pleasure that we extend our congratulations to Dr. Edward Orton, the new president, and we say with all candor that we consider it to be an honor well bestowed.

But the spoils for Ohio did not end with the presidency. When the time came for selecting a place of meeting for next year, Columbus was the place chosen. This in itself will be a great event in the history of Columbus, and especially in the life of the Ohio State University. What will it mean? It will mean that hundreds of scientists, the leaders from all over the country, will be gathered in this city, and that our University will be thoroughly inspected in all departments. It means that our faults and needs as well as our advantages will become apparent to all the leaders in education throughout the country, and, further, it means that we will become better known, and more appreciated than we have been before this time. On the other hand, it means a vast amount of work to be done in all departments in preparing for this great event. Not only through the University, but throughout the city, must complete arrangements be made. The expenses will be heavy and must be met. The delegates must be looked after and cared for, excursions planned and detailed arrangements made for everything. It will mean a busy year about the University.

During the past year there have been many attacks made upon the policy of O. S. U. in branching out beyond the original plans as they were formulated for the "Ohio Agricultural and Mechanical College." It has been said and repeated many times that the change from a college to a university has been detrimental to the interests of the original plan, that is, to education in agriculture and the useful arts. For an answer to such a question we have but to refer to the statistics of the College of Agriculture and see whether an increase or a decrease is noted there; if a decrease has occurred the parties making the state-

ments above referred to are correct, if an increase, they are wrong. In another place in this magazine will be found a statement of the number of students in the College of Agriculture for the past several years, and it will be seen at once that instead of decreasing (as, we are sorry to say, some departments of the University have done), the number of students in the College of Agriculture has constantly been upon the increase. In an address before a national organization not long since, the president of that organization took for his theme, "Turning Things Over," and among other things which he considered would be benefited by that process was the Ohio State University. His reason for turning the institution over was that agriculture was being neglected while other colleges of the University were being favored. It is well known by all who are well informed that the College of Agriculture is at present the most flourishing part of the University, and we are sorry that the gentleman who wanted things turned over was so ill-informed.

Columbus Horticultural Society.

The Columbus Horticultural Society held its regular monthly meeting on Saturday, September 24, in Horticultural Hall. It being the first meeting after the summer vacation, many of the members had interesting observations to report. The regular program was as follows:

"The Propagation of Fruit Trees From Cuttings," Fred K. Luke; "Judging and Scoring Fruit," Prof. Wm. R. Lazenby.

The discussions following these papers were interesting and contained many instructive suggestions. Mr. Luke has spent much time upon the study of cuttings and their propogation. He is working the subject up for a thesis for his doctor's degree at Cornell University, and his experiences have been quite extensive and well conducted.

Personal Items.

Mr. John T. Dallas, formerly of the class of '98, is about the University again and expects to enter later in the year. Mr. Dallas is just back from the Klondyke, where he has been for one year. While being sound physically and under no disadvantages from his year's outing, he says the best place to be in is in the "states."

Homer C. Price, '97, paid us a visit shortly after school opened. Mr. Price goes on to Cornell University, where he has the fellowship in agriculture for one year.

Frank Ruhlen, '96, is now filling the position of assistant in agriculture and foreman of the University farm, lately vacated by Charles W. Burkett. Mr. Ruhlen has been engaged in general and dairy farming since his graduation. For some time he had charge of a large dairy at Mentor, O.

Mr. Fred K. Luke, recently of Cornell University, has charge of the greenhouses in the Department of Botany. Mr. Luke has had a good experience in floriculture and general horticulture, having completed a course in the University of South Dakota before going to Cornell.

We have just received a copy of Agricultural Education from the New Hampshire College of Agriculture and Mechanic Arts. Agricultural Education is a quarterly magazine devoted to the interests of scientific agriculture, and is published by Charles W. Burkett, the first editor-in-chief of The Agricultural Student. The magazine is neat in make-up, is well printed upon good paper and its general tone is that of neatness and order. Mr. Burkett is to be congratulated upon the early success of his enterprise, and knowing the ability of the editor we predict a marked success and warm reception for the new magazine.

Mr. C. W. Waid, '98, who graduated in the course in horticulture and forestry, paid us a visit just before school opened. Mr. Waid is engaged in practical horticulture at Emery, O., and makes a specialty of berries and melons.

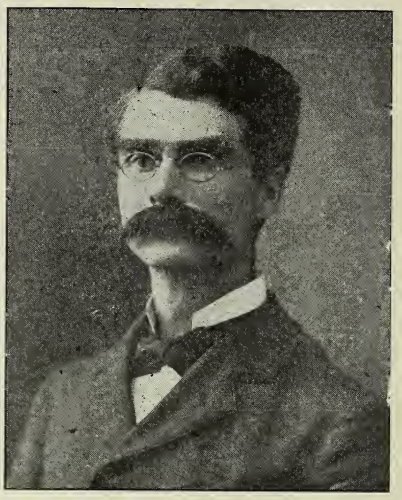
Prof. E. E. Bogue, O. S. U. '94, now professor of entomology in the Oklahoma Agricultural College, paid us a visit the past summer. Professor Bogue is also entomologist for the Oklahoma experiment station, and has published some valuable buletins from that station.

Mr. E. Meade Wilcox, O. S. U. '95, has been spending the past summer at his home in Columbus. Mr. Wilcox is assistant in botany at Harvard University and is making a special study of the maturation of buds as regards the changes in the bud.

Passed Away.

The many friends of Frank A. Henderson, of McConnellsville, O., were much pained to learn of his death, which occurred on September 27th. He would have beena third-yearstudent in the long course in agriculture had he entered college this year. As it was he withdrew from the University about the first of last January on account of ill health. He had 122 hours work in the University to his credit.

Frank A. Henderson was a young man of the most sterling qualities. He was true and honest, persevering and unassuming—just the kind of a young man that the world needs today to hold in check the reckless dash of the more thoughtless brood of mankind. The influence he exerted everywhere was the best, and his many true friends will sorely miss him from their midst.



PROFESSOR HERBERT OSBORN.

Herbert Osborn was born on the 19th day of March, 1856, at Lafayette, Walworth county, Wis. When seven years old he moved to Fairfax, Ia., where he attended the home schools until 17 years of age, when he entered Iowa College, at Grinnel. In 1876 he entered the State Agricultural College at Ames and graduated in 1879. During his college course he paid his expenses by working in the museum during the term and teaching school in winter.

Upon graduation he was elected to the position of assistant in zoology and entomology, and in 1880 he completed his course for Master's Degree. He spent the winter of 1881-82 at Cambridge, Mass., studying in the Museum of Compatative Zoology under Dr. Hogen.

In 1884 he was placed in charge of zoology and entomology in Iowa State Agricultural College and has held that position until accepting a like position with the Ohio State University.

In 1885 he was commissioned a special agent of the U. S. department of agriculture, division of entomology, and held the same position until 1894, working upon the insects of Iowa, and carrving on special investigation of certain insects in Wisconsin, Kansas and Missouri. In

1890 he was assigned to the duties of entomologist of the Iowa Experiment Station, which position was retained until his acceptance of the position which he now holds. Under the state law he was made state entomologist, charged with the enforcement of the inspection laws, in 1898.

For about twenty years he was a member of the Iowa State Horticultural Society, contributing many papers to its transactions. He was also for many years a member, and for two years secretary, of the Southeastern Iowa Horticultural Society, editing the proceedings and contributing papers.

He took an active part in the organization of the Iowa Academy of Science in 1887, was its first president and from 1891 to the present time secretary, editing proceedings and contributing numerous papers.

He was president of the Entomological Club of the American Association for the Advancement of Science, 1891; president of the Association of Economic Entomologists, 1898 (Boston meeting); member of American Entomological Society, Entomological Society of Washington, Biological Society of Washington, Societe Entomologique de France and Society for the Promotion of Agricultural Science; Fellow of the American Association for the Advancement of Science. He is the author of "A Key to Common Genera of Insects," Partial Catalogue of the Animals of Iowa (covering Vertebrates and a number of groups of insects), "Insects Affecting Domestic Animals," a 300-page bulletin published by the U. S. Department of Agriculture; contributions from the Department of Zoology and Entomology Iowa State College," numerous bulletins and bulletin articles from Iowa Experiment Station and the Division of Entomology, U. S. Department of Agrculture; articles on insects in scientific journals and society proceedings, namely: In Insect Life, Canadian Entomologist and the Proceedings of the Iowa Academy of Science, and the Association of Economic Entomologists. Beside these he has written many short articles for agricultural papers, especially Iowa Homestead, Orange Judd Farmer, Prairie Farmer, etc. He has made trips through Mexico as far south as the Isthmus of Tehauntepec, via City of Mexico and Vera Cruz; also in Europe, visiting museums and laboratories in London, Paris, Berlin, Leipsic, Munich, Florence, Rome, and spending three months at the Zoological Station at Naples.

He was married in 1883 to Alice J. Sayles, a graduate of Iowa Agricultural College, a class of 1881. He has five children—two boys and three girls.

Professor Osborn's special study has been upon insect parasites upon domestic animals and of insetcs injurious to grain.

Field Work in Archaeology.

One of the most interesting finds during the field work of the Ohio State Archaeological and Historical Society, under the personal supervision of its curator, W. C. Mills, class '98, was made in southern Knox county, in a group of mounds known as the "Larimore Group," composed of ten mounds and one large fortification. Four (4) of the ten mounds are also fortified.

Mound No. 5, situated on a line east and west between the large fortification and one of the fortified mounds, was perhaps the most interesting. This mound is situated in a field on the farm of Mr. Frank Sutton. This field has been in cultivation for more than half a century, consequently the mound was about 18 inches high and the original diameter 35 feet. Mr. Joe Larimore, whose farm adjoins Mr. Sutton's, says he can remember when the mound was 5 or 6 feet higher.

Nothing was found in this mound until the original surface was struck, where a skeleton of a young person was found. Beneath the skeleton the ground had the appearance of being disturbed and the explorers removed the soil to the depth of five and a half feet, where was found

in one heap the remains of five headless bodies. These no doubt were killed in battle and the heads removed as trophies of battle and carried away by the victorious enemies. With the skeletons were found a number of arrow and spear points. In one of the bones of the pelvis was found an arrow imbedded firmly in the bone. This was carefully removed and can now be seen at the museum. Upwards of 300 shell beads and 30 large ornaments made of mussel shell, and quantities of drilled beaver teeth and parts of turtle shell with holes drilled through were abundant; also several bones of the deer and other wild animals were placed in the grave. The bodies were promiscuously placed in the grave and the bones of the skeletons were nicely preserved, as the grave was dug in the gravel. The burial below the surface was one of the features of the "Larimore Group."

Registration.

The number of students who have entered the Ohio State University up to October 1st is 950, compared with 925 at the same date last year and 884 on October 1st, 1896. The number of students in the College of Agriculture and Domestic Science is 121, as compared with 102 last year and 81 the year before. The following table gives the number of students in the College of Agriculture by course and years, compared with the same date in 1895, 1896 and 1897:

	1895	1896	1897	1898
Post Graduate	3	2	3	.....
Four-year Courses				
Fourth Year	7	4	10	6
Third Year	3	10	7	15
Second Year	11	8	11	20
First Year	16	11	35	24
Two-year Courses				
Second Year	9	8	7	14
First Year	19	38	29	42
Totals	68	81	102	121

Of those who have entered this fall, 30 are young women who have entered the Courses in Domestic Science, as compared with 12 last year. The number of students in the first years of the four and two-year courses is 66, as compared with 64 last year and 49 the year before. The students in the advanced years numbered 32 in the fall of 1896, 38 in the fall of 1897 and 55 this fall.

Tests of Grass Seed.

The Department of Agriculture of the University recently had occasion to purchase a considerable quantity of blue grass and red-top seed. Accordingly, requests were sent out to seedmen for quotations and samples. Two firms responded to this request. A wide variation in prices was noticed in the case of each firm. Firm No. 1 quoted fancy blue grass at $10.40 per hundred pounds, extra clean blue grass at $5.75, fancy red top at $10.75, and prime red-top at only $7.00 Much the same variations were noticed in the quotations of Firm No. 2.

The problem before us was, which grade of blue grass and which grade of red-top to select; in other words, which grade would give us the greatest number of seeds for each dollar invested. Accordingly, a given amount of seed of each grade, 50 milligrams, was carefully weighed out and the seeds accurately counted. From these figures it was easy to determine the relative (not actual) number of seeds that one dollar would buy. The results are given in the following table:

Name.	Quotation per 100 lbs.	No. Seeds in 50 mg.		Rel. No. Seeds for $1.
Firm No. 1—				
Fancy blue grass	$10 40	50 mg.	242	23
Extra clean blue grass	5 75	50 mg.	270	47
Fancy red top	10 75	50 mg.	407	37
Prime red top	7 00	50 mg.	228	32
Firm No. 2—				
Old fancy blue grass	7 50	50 mg.	254	33
New fancy blue grass	7 75	50 mg.	180	23
D'ble ex. clean blue grass	5 50	50 mg.	181	33
Extra clean blue grass	3 50	50 mg.	324	92
Maraud (fancy red top)	6 50	50 mg.	465	71
Alien (red top)	5 00	50 mg.	148	29
Blithe (fancy red top)	4 50	50 mg.	292	65
Guard (red top)	2 50	50 mg.	260	104

It will be observed in the case of No. 1 that extra clean blue grass at $5.75 per 100 pounds gives us twice as much seed

for one dollar as does the fancy blue grass at $10.40 per 100 pounds. The two grades of red-top offered by this firm are more nearly proportional in the amount of pure seed one dollar will buy.

In the case of Firm No. 2 there are also wide variations. If we buy extra clean blue grass at $3.50 per 100 pounds, we get four times more pure seed for one dollar invested than if we buy new fancy at $7.75 per 100 pounds. Also if we buy Guard (red-top) at $2.50, we get three and one-half times more seed for one dollar than if we buy Alien (red-top) at $5.00 per 100 pounds.

In making the above comparisons we have assumed that all grades of seeds have the same germinating power.

W. D. GIBBS.

Notes on Feeding Cows.

There has not been as much attention given to the feeding of our dairy cows as should be for the best interests of the dairy industry of this state. Many feeders, in fact most men, do not know what will give the best results. For that reason, with others, the writer made some feeding tests with different rations and feeds. They were made on a private herd and to find out the best food for milk production at the least expense. Many farmers think when a cow gets all of the good pasture she wants, that she cannot be made to produce more milk.

In this test one company sent us several different kinds of bi-products from the manufacture of rolled oats; also different combinations of corn and oats, to be fed as a trial. We also fed bran, corncob meal and gluten feed (which is made from bi-products from the manufacture of glucose). The foods were mixed in all kinds of combinations and fed alone, fed with cows on good pasture, when on dry fodder and with other green fodder in the manger.

In every test it showed grain to be a help, as every time we shut off on grain the cows would drop off on milk (every cow's milk was weighed).

We found that gluten feed gave the best results, as it would make more milk than any other grain. We never fed very heavy of this grain, but have fed as high as five pounds with good results. I would not advise feeding more than three or four pounds for any great length of time.

Even when the cows were on the best of pasture, they would respond to gluten feed enough to more than pay the expense of feeding.

The gluten feed is very rich in nitrogenous matter, so we think this experiment proved that our feeding rations are too wide as a rule; but owing to the cost of foods rich in nitrogenous matter, it has been cheaper to produce milk by feeding a rich nutritive ratio rather than pay the extra price to get the narrow ratio; in other words, it was cheaper to feed the extra starch rather than buy the nitrogen to make the ration more nearly balanced. I think the same rule might hold good in other lines of feeding if it was carried out, and it is the privilege of every farmer farming for himself to make some such experiment at a small cost and a very great gain. Let us, as farmers, do what we can along this line, then report in some publication so other people can get the benefit.

FRANK RUHLEN.

A Plea for Manual and Industrial Trainiug in Horticulture.

(Prof. Wm. R. Lazenby.)

It is claimed by those able to judge that there is a large proportion of useless work expended in our common and public schools. It is unhesitatingly asserted that some of the branches there taught are nearly or quite useless in themselves, and that other subjects are so burdened with petty details that the real purpose or object of the study is obscured. In other words, the pupil loses much by the time spent on some subject and gains little or nothing of what other subjects might and should have brought him.

It is generally conceded that there are three factors in any well rounded education. These are knowledge, training and culture. This means the education of all the faculties, the development of the physical, mental and moral forces so that man shall be fitted for his most perfect work. It goes without saying that the nearer we can come to a systematical and perfect development of the mind, body, and heart, the better are we prepared for the work of life.

The true teacher must ask, and as far as possible answer the following questions for each of those committed to his care:

First—What knowledge to you most need?

Second—What training do you most need?

Third—What culture do you most need?

In other words, to know something, to do something, and to be something comprises a large part of the best preparation for true living. Such an education enables its possessor to perform his duty in all the exigencies of life, and brings him the most complete and lasting happiness of which he is capable.

As a rule the means for acquiring knowledge and culture have been well provided for in our various systems of education.

Studies and means of instruction are usually selected with reference to their supposed ability to answer the following demands, viz.: First, what is value of the learning they will give? and, second, what is value of culture their mastery will bring?

Whether the means employed always give the best knowledge, or bring the truest culture, may be questioned.

There can be no question, however, about the lack of training. Of teaching there may be a plenty; of training of the right kind there is a dearth. It may be difficult to state the exact difference between teaching and training. In a broad sense the teacher includes the trainer. In a common and narrower use of these words the difference may be stated as follows:

Teaching means imparting knowledge; conveying ideas; it shows what has been done and why it has been done; it explains causes and deals with theories and principles; it stimulates and inspires the pupil or student to mental activity. Training does little in the way of imparting knowledge; it shows methods; it deals with the how rather than the why; it applies rules and principles to the practical affairs of life; it stimulates and inspires the pupil or student to some form of physical activity.

The teacher demands that the pupil or student shall study; the trainer demands he shall work, or at least blend labor with study. We live in an age that demands a system of education which recognizes the truth that man is by nature a worker, a moulder and ruler of matter—an age which is beginning to realize that daily physical as well as intellectual effort is one of the conditions of a healthful and happy existence. In short what the age demands is the education of the head, heart and hand together, each to be the ally and complement of the others. I am aware that all educators do not share in this belief, yet I rejoice that there are few today who inquire, either sneeringly or pityingly, with the apocryphal writer of Ecclesiasticus: "How can he get wisdom that holdeth the plow, that glorieth in the goad, that driveth oxen and is occupied with bullocks?" Such questions are dictated by the spirit of the past. It is a spirit of the night and not of the dawning day of the nineteenth century.

It needs no argument to show that the educational training required to make an able lawyer, or an efficient clergyman is not the same as that which is essential to the proper equipment of an agriculturist or an engineer. The routine of the classical course may do for the former but it will fail to properly develop and equip the latter.

Has not our present national crisis demonstrated that the training, manual as well as mental, that is given by our national military and naval schools is just what is best calculated to fit a youth for eminence and renown as a military or naval commander. If this be true for the art of war, can it be any the less true for the peaceful arts and great industries of our time?

Shall rigid, persistent manual training with implements of destruction count for so much and the choice and use of implements of production count for so little? No! We should train men for peace as well as for war! We should give our aspiring youth an opportunity to do better than their fathers in every field of blended intellectual and industrial effort, and show them in what direction further improvement is to be made. Among the more prominent arts and industries perhaps there is none that has superior advantages over horticulture. This art consists primarily in transforming by means of cultivation, the crude and unused elements of earth and air into valuable food products, or living objects that minister to our aesthetic nature.

It is both an industrial and a fine art, readily separating itself into four great divisions, each of which may be many times sub-divided.

These four divisions are:

I. Pomology or fruit culture.

II. Olericulture or vegetable gardening, including seed growing.

III. Floriculture—commercial and amateur.

IV. Landscape-horticulture, or the chief factor in landscape gardening.

No vocation is more conducive to physical and moral health than that of horticulture. But horticulture is more than a healthful vocation. Its intelligent and successful practice is based upon great principles which have been deduced from the natural and physical sciences. The horticulturist stands face to face with problems which require for their solution the amplest knowledge of nature's laws, the fullest command of science, and the best efforts of the human intellect. In other words, horticulture is an intellectual pursuit and in its practice the strongest minds may find scope for profitable employment. Every useful vocation is respected in proportion to the measure of intellect and skill it requires and rewards.

Horticulture is esteemed by all and the reason is obvious.

It is in the realm of fine art where horticulture has the deepest and most abiding influence. There is a wealth of beauty in tree and shrub, in fruit and flower and leaf—a beauty which, according to Emerson's averment, "is its own excuse for being."

When horticulture as a fine art arranges trees and shrubs, flowers and lawn, so as to present an expressive picture to the eye, the beauty is multiplied, and this development of the beautiful is the aim and object of all landscape-horticulture. Who can fully measure the effect of the horticulture of our parks and public grounds, or estimate its value in the external adornment of the home. We do well to make the interior of our dwellings beautiful; to decorate and adorn them with the products of the artist's skill; but we should not forget that the sense of beauty must be cultivated before we can appreciate the treasures of art and make them our own.

It is through horticulture that the eyes of childhood and youth may be trained to see the beautiful in nature. Through horticulture the blinded eyes may be opened, the dormant aesthetic powers awakened, and the heart made ready for a just appreciation of the glories of nature and the triumphs of art.

Perhaps enough has been said to prove the advantages of horticulture as a means of training. Its advantages as a vocation or life work could be shown quite as easily. In doing this the object is not to belittle or disparage any other legitimate method of training or any other calling. Other vocations are useful, even neces-

sary, and many follow them with advantage to themselves and to others.

The fact remains, however, that horticulture is the first and most essential of human pursuits, and the interests of all demand that it should be honored and prosperous. To pursue this vocation with satisfaction and profit, boys and girls must be trained therein. To this end manual training departments in horticulture should be established and maintained in connection with our elementary and high schools, and industrial and experimental training in the art should be provided in our technical schools, colleges and universities. The small amount of land required and the necessary equipment in the way of tools, seeds, etc., would not be expensive. For winter, and to use during the inclement weather of other seasons, a glass structure, in the external form of an economical commercial green house, should be provided. The work undertaken in those training departments should embrace among other things the laying out of a model kitchen garden, a market garden, and small fruit plantations. It should include, also, the cultivation of flowers, shrubs and trees. In connection with the above the various operations of propagating plants by seeds, cuttings, layers, budding, grafting, pruning, transplanting, etc., should be thoroughly taught. The collection and planting of weeds, the breeding of the more common injurious insects; the use of insecticides and fungicides, the observation and study of our useful birds, the management of bees, and other similar subjects, might form a part of the instruction and training. This is a training by horticulture, a training in horticulture, and a training for horticulture.

In addition to the tools of the shop, we urge the tools of the garden. The hammer and the saw should be supplemented by the hoe and the rake. The budding knife and the pruning shears, as well as the plane and chisel, should be used to educate the hand and eye.

We hear much in this day about reform in our systems of education. In an age of free-school and compulsory school attendance, there should be more and better fruit gathered from the tree of knowledge. That is certainly a defective, if not radically false, system of education which leaves its subject no better qualified for any useful calling, with no more strength to wrestle with adversity, with no more power to maintain a healthful independence, than though he were unlettered.

The great problem of educational reform is the proper blending of labor with study so as to develop skill of body as well as vigorous activity of mind.

We need a system of education which recognizes the fact that men and women were placed on this earth that they may work, and that every attempt to escape this destiny should subject the offender to the logical penalty—poverty and starvation. A pupil so trained in our common and public schools should be able to nearly, or quite, work his way as a student through college or university, and would then go forth fully equipped to meet the responsibilities of life.

It is only through an education like this that the great masses of our people can ever attain the position and develop that self-respect which the genius of our age predicts and requires for them.

And although a good beginning has been made, this education, for the most part, has yet its schools to modify and its teachers to train or discover.

A Comparison of Fore-milk with the After-milk.

It is a pretty generally accepted theory that the fore-milk, or first milk from the cow's udder, is deficient in butter fat as compared with the strippings. It has been further claimed by the bacteriologists that the milk vent in the cow's teat becomes infected from one milking period to another with bacteria, some of which are harmful to the consumer of the milk. These bacteria are supposed

to be washed from the teat when the first milk is drawn. Some experimental work has been done on this subject by the Wisconsin Experiment Station (Bul. No. 18), by the Indiana Experiment Station (Bul. No. 24), and also by the Dairy Department of the Ohio State University. The Wisconsin experimentors found by numerous analyses of such milk that the first milk drawn from the teat very rarely contained over two per cent., and quite often drops below one per cent. of butter fat, while the strippings quite often contained eight to ten per cent. of butter fat. Samples of the first milk were drawn from seven cows in the dairy herd of the Wisconsin Station, the whole milk of which tested between three and four per cent. These samples contained an average of 1.51 per cent. of fat. The individual samples ranged from ninety-eight to one and ninety-nine-hundredths per cent. of butter fat. Five samples of strippings were drawn which averaged nine and four-tenths per cent., with a range from six and four-tenths to eleven and nine-tenths per cent.

The Wisconsin Station also found that the difference in the composition of the first and last milking is confined entirely to the fat, the milk serum having approximately the same composition from the beginning to the end of each milking period, so that the ratio between the water and the solids not fat throughout the entire milking remains the same. To prove this point the following analyses were made:

	Composition.			Composition of milk serum.	
	Water	Solids	Fat	Water	Solids
First milk ...	88.17	11.83	1.32	89.35	10.65
Strippings ...	80.82	19.18	9.63	89.43	10.57
First Milk ...	88.73	11.27	1.07	89.69	10.31
First milk ...	88.73	11.27	1.07	89.69	10.34
Strippings ...	80.37	19.63	10.36	89.66	10.34

These experiments show that notwithstanding the fact that the fat changed about 9 per cent., the composition of the serum remained constant, the differences here attributed falling within the error of analyses.

The Indiana Experiment Station, after conducting an experiment of several days' duration, on six cows belonging to their herd, came to the conclusion that the *relative difference* between the amount of fat which the first and last milk contained, was 43.55 per cent. in favor of the last milk. That is to say that the butter-making value of the last half of the milk is 43.55 per cent. more than that of the first half.

The Agricultural Department of the Ohio State University conducted an experiment on its dairy herd of thirty-six cows. The herd was subjected, as nearly as possible, to uniform conditions throughout the experiments. They were under the supervision of the Professor of Agriculture of the University. Each cow was milked in her regular order and by the same milker each day.

The first milk from each teat was saved, and at the end of the milking they were all poured together, weighed and a sample drawn for analysis. The remainder of the milk from the whole herd was then weighed and a sample drawn for analysis. The result of the analysis is given below:

EXPERIMENT No. 1.

Three pulls were taken from each teat.

	First Milk.		Whole.	
	Weight lbs	% Fat	Weight lbs	% Fat
July 13—A. M.	10.3	1.4	290	4.6
P. M.	11.2	1.2	280	4.7
July 14—A. M.	10.7	1.2	323	4.8
P. M.	10.5	1.6	268	4.6
July 17—A. M.	8.0	1.3	305	4.6
P. M.	8.0	1.5	256	4.6
July 18—A. M.	8.0	1.0	298	5.1
P. M.	10.0	1.5	255	4.7

At the price realized for the milk, 6 cents per quart, there was a loss of 9.2 cents per day in the fore-milk, or a loss per cow of .0027 cents per day.

EXPERIMENT No. 2.

Two pulls were taken from each teat.

	Fore-milk.		Whole.	
	Weight lbs	% Fat	W'ght lbs	% Fat
July 22—P. M.	8.8	1.3	275	4.8
July 23—A. M.	7.0	1.0	285	4.6
P. M.	8.5	1.1	278	4.6
July 24—A. M.	7.0	1.0	280	4.9
P. M.	7.8	1.2	281	4.5
July 25—A. M.	8.0	1.1	304	4.7
P. M.	7.0	1.2	248	4.6
July 26—A. M.	7.0	0.9	306	4.5

This experiment shows a total loss of 6.13 cents worth of butter fat, or a loss of .0018 cents per cow per day.

EXPERIMENT No. 3.

One pull was taken from each teat.

	Fore-milk.		Whole.	
	Weight lbs	% Fat	W'ght lbs	% Fat
July 30—A. M.	4.2	1.1	324	3.6
P. M.	4.0	1.2	277	4.1
July 31—A. M.	3.9	1.1	311	4.1
P. M.	6.0	1.3	304	3.8
Aug. 1—A. M.	3.5	1.3	311	4.0
Aug. 2—A. M.	3.2	1.0	326	3.9
Aug. 3—P. M.	3.0	0.9	277	3.8
Aug. 4.—A. M.	3.2	1.0	302	4.1

In this experiment there was a total loss of .0372 cents worth of milk per day, or a loss of .0010 cents per cow.

After the samples were drawn from the fore-milk and the whole-milk, the bottles were resealed and allowed to stand until soured, when it was observed that the sample from the first milk possessed an offensive putrid sour odor, which would seem to indicate that there were large quantities of putrefactive bacteria in the first milking, while the whole milk had a very pleasant, agreeable sour odor.

These bacteria become lodged in the milk vent of the teat and the first spurts wash them out. In practice the milkers are instructed to reject the first two spurts from each teat because it is believed to enhance the hygienic value of the milk as a food.

C. B. STEWART.

Tomato Breeding.

There is probably no plant we have so much literature upon and that has been studied so thoroughly from the standpoint of plant-breeding, as the tomato. This is doubtless due to the fact that it is easily grown, commonly used and offers exceptionally good opportunity for study.

The tomato plant is quickly susceptible to careful selection, and it is by this that value is given to cross results, whether natural or mechanical.

In selecting tomato seed it has been demonstrated that the plant as a whole has more hereditary influence than the character of the individual fruit.

Repeated experiments have shown that nothing is gained by selecting seeds from first ripe fruit, regardless of the character of the plant from which they come.

When new varieties are desired through crossing, the foregoing applies equally to each parent. The more uniform and persistent the parent, the greater is the chance that its characteristics will be transmitted.

When the desired variety is once realized, it is kept only by constant attention to selection. It is doubtless chiefly due to carelessness in selection that our varieties of tomatoes as a whole are so comparatively short-lived.

Tillage, fertilization and other treatment of plants have their effect upon tomato breeding. Poor soils and insufficient cultivation tend to revert the variety.

Keeping quality evidently has not been generally taken into consideration, up to the present time, in breeding the tomato. Experiments at the Cornell, New York, station go to show that solid varieties may not be the best keepers.

Hybridizing between the larger varieties and the clustered, or currant tomatoes, generally results in producing fruit intermediate in size.

Crosses between the large or potato-leafed and common-leafed varieties usually result in an intermediate foliage.

The red varieties seem to have the power to stamp their color on the offspring of crosses with other colors.

Varieties of tomatoes mix very readily when grown in the same field. Pure seed should be selected from isolated varieties.

The tomato, as with other crops, needs a rotation. The plants grown on the same land from year to year, although highly fertilized, naturally degenerate in time.

In order to secure results from crossing the tomato, one cannot be too well acquainted with the parent varieties, nor have too clearly defined plans of procedure. Haphazard crossing is of little value. When the parents are very different in character, the chances are that the offspring will be weak, while the offspring of closely-related species or races is likely to be very vigorous.

ORIGIN OF TOMATOES.

The evolution of our cultivated tomatoes is interesting. The two species from which all our garden varieties have originated are *Lycopersicum pimpinellifolium* and *Lycopersicum esculentum*. The former includes the "currant" varieties, which are small and form in large clusters, sometimes spoken of as "Raisin" tomatoes. This species is a South American variety, and is found growing wild in both Brazil and Peru. Although known for some time, comparatively little use has been made of them, except for pickles, preserves, and for ornamentation.

L. esculentum is the species from which our commercial tomatoes come. It is thought also to have originated in Peru, although it has been found in other countries, as in Mexico and California, in a form similar to the cherry tomato.

HISTORY OF GROWTH.

While the tomato was known in Europe as far back as 1561, but four varieties were found in England in 1819. In these early days it was grown mainly for ornament. Professor Munson finds that the fruit was first introduced into this country at Philadelphia by a French refugee from St. Domingo, in 1798, and again by an Italian painter, Comi, at Salem, Mass., about 1802. The beginning of general culture of the tomato for market is placed at about 1830. From this time up to the present, the evolution of the tomato has been steady. From the flat, rough and angular tomatoes, beautiful round, regular fruits have been developed. The Paragon variety was the first to be developed. Since then other superior varieties have come and gone. One would think further improvement almost an impossibility, but doubtless the advancement of the next ten years will be as great, if not greater, than that of the last decade.—F. W. Rane, in *Agricultural Education*.

Horse-flies.

(James S. Hine)

Horses, cattle, hogs and sheep are annoyed by numerous insect enemies, but probably by none more than by the various members of the family of flies known as Tabanidae, and commonly called horse-flies. The different species of this family seem to be local in distribution, for in one locality this one is most common, while in another that one causes by far the most damage. For example, one author writing in regard to the western prairies states that the green-head horse-fly, Tabanus lineola, is the most abundant species. From Missouri comes the statement that Tabanus molestus is an abundant pest, while observations in Ohio covering several years make possible the statement that no other species is as common anywhere in the state as is Tabanus sulcifrons, Macq. on parts of the Western Reserve.

Also, different species occur at different seasons. For instance, certain species appear in June and are gone when other species are abundant later in the season.

The eggs of the Tabanidae, so far as I have observed, are deposited in groups in the vicinity of water. Chrysops sordidus I found ovipositing on Sagittaria that grew in shallow water in Sandusky Bay several rods from the shore. Chrysops niger I observed placing its eggs on sedges that grew at the water's edge of a small artificial lake on the University campus. Tabanus coffeatus was taken at Oxford, Ohio, while depositing its eggs on stones in a small brook. The masses of eggs of the different genera observed have very much the same appearance and are composed of a varying number of "spindle-shaped" ova firmly glued together. These masses are usually black with a grayish tinge in places.

From the manner in which the eggs are placed, we conclude that as soon as the young larvae are hatched they enter the water and there live on minute aquatic life. How this last may be I have not proven by actual observation. If the young larva of Tabanus atratus lives in the water, it must leave it of its own accord later, for I have found on several occasions the nearly mature larvae of this species by digging in the ground and in rotten wood on the banks of streams and ponds. The past spring I collected some of these larvae for the purpose of studying their feeding habits. I kept them separately in jars of very moist earth and fed them various larvae and pupae. They do not hesitate in the least to eat their own kind, for on one occasion I placed a live pupa of the species in question in a jar with a larva of the same species. In a few hours I visited the jar again and found only the mutilated skin of the fine pupa, while just beneath the surface I found the larva distended almost to bursting. Among the material accepted as food by the various larvae were the larvae of various Lepidoptera and Diptera and pupae of Coleoptera.

Most farmers are well aware of the injury to stock by horse-flies, but only a few know that these same insects are beneficial in their immature stage and possibly fully pay in advance for the damage they do in later life.

There is another point to consider in this connection; the adult males of none of the horse-flies are injurious to stock, but live upon the pollen of flowers and the like. Therefore we suppose that half the specimens produced are males and that male larvae have the same habits as female larvae. Accordingly the damage as compared with benefits is still more lessened.

I do not mean to be understood that the production of horse-flies should be encouraged, but would like to make plain the value of knowing the life histories of our economic insects.

The remedies for these insects are not satisfactory. The use of nets on roadsters and work horses is partially satisfactory, but for animals in pasture we can make no definite statements.

However, certain greasy or oily substances seem to have a repelling effect at first, but their value is of such short duration that one hardly gets satisfaction enough to pay for the application.

Hogs can protect themselves against the bites of various flies if they can get to the water. If other stock can get in the woods among underbrush during the warmer part of the day they are able to combat these and other flies quite successfully.

Rothamsted Wheat Experiments.

During the fifty years between 1843 and 1893, a series of experiments on wheat were conducted at Rothamsted, England, to determine the value of farm yard manure, various chemical manures, and no manure in the production of wheat.

The conditions under which the experiments were conducted may be briefly stated as follows: In 1839, the whole field was manured with farmyard manure, after which a five-course rotation was grown, consisting of turnips, barley, peas, wheat and oats.

In the experiment without manure the first eight years, 1844-51, were not counted in the direct results of the experiment as it was thought that the accumulation due to comparatively recent manuring might influence the results. The whole experiment was divided into periods of eight years. The average yield for the five eight-year periods was 16 1-8, 13 1-2, 12 1-4, 10 1-2, 12 3-4 bushels; for the forty years, 13 bushels, and for the whole fifty years 13 1-2 bushels. As to the rate of decline due to exhaustion. it was found that on an average it amounted to a little more than one-sixth of a bushel per acre from year to year over the forty years from 1852-91.

In the experiment with farmyard manure, there was used 14 tons to the acre every year. For the first eight years the average annual produce was 28 bushels. The average for each of the five remaining eight-year periods was 34 3-8, 35 3-4, 35 3-8, 28 5-8 and 39 1-4 bushels. The average produce over the forty years, 1852-91, was 34 7-8 bushels; and the average for the whole period of fifty years, 1844-93, was 33 1-2 bushels per acre per annum. It was found that on this land there was an average annual increase in produce due to accumulations from the manure, of 5 1-8 bushels over the forty years from 1852-91, while the average increase from year to year, if uniform throughout the period, would be a little over one quarter bushel over the forty years from 1852-91.

In order to ascertain which constituents of farmyard manure were the most effective, a series of experiments were carried on with various artificial manures. The manures used were superphosphate, sulphates of potash, soda, and magnesia alone and together with various quantities of ammonium salts. The average of the forty years by mineral manure alone shows an increase of only two bushels over that where no manure at all was used. The first and second additions of nitrogen to the mineral manure gave a marked increase, but the third addition did not give a large return. This serves as an illustration of the inapplicability of conclusions from manure experiments when the condition of the land is too high already or when an excess of manure is applied. A given quantity of nitrogen in the form of nitrate yielded more produce than an equal quantity in the form of ammonia. The nitrate being always applied in the spring was not subject to winter drainage. It is, however, very soluble and becomes rapidly distributed and available, but it is, at the same time, very subject to drainage after sowing if heavy rains follow. It was concluded then that since minerals were not deficient, the increase was in proportion to the available nitrogen, when it was not applied in excess. An interesting part of the experiment is in the effect upon the carbohydrates produced. It was found that for one pound of nitrogen applied as manure, there was an increased production of carbohydrates, in the grain and straw of wheat, of 28.8 pounds when 43 pounds of nitrogen were applied as ammonium salts; of 29.7 pounds when 86 pounds were applied as ammonium salts, and of 36.5 pounds when 86 pounds were applied as sodium nitrate.

During these experiments it was found that the relative excess of nitrogen in the soil is little, if at all, due to the direct retention of the nitrogen of the manure; and that it is almost exclusively dependent on the difference in the amount of the crop residues (of the stubble and roots, and perhaps of weeds), of which there will be the more the greater the amount of crop grown.

On the unmanured land when analyses were made of the soil, it was found that there was a gradual diminution of the amount of nitrogen in it. With the ground manured with farmyard manure, there was a great accumulation of nitrogen, it being about twice as rich in nitrogen as any other part of the ground in the experiment. But in spite of the fact

that a large amount of the constituents in farmyard manure accumulates in the soil, the wheat crops on the dunged ground seldom, if ever, show over luxuriance, and in unfavorable seasons the produce has been comparatively small, largely owing to the encouragement of weeds, and especially of grass.

It may then be said that wheat was grown successfully for fifty years in succession, without manure, with farmyard manure, and with various artificial manures, on ordinary arable land. The manured and unmanured pieces of land were treated in exactly the same way in each of the fifty years. The artificially manured plats did not, however, receive the same manure from year to year during the first eight years, 1844-51; but, with a few special exceptions, each has been treated uniformly during the forty-two years, 1852-93, inclusive. The yields obtained show 34 5-8 bushels to be the annual average for the farmyard manure field and 13 bushels for the unmanured field. The results on the artificially manured lots show that mineral manures alone gave very little increase of produce; that nitrogenous manures alone gave considerably more than mineral manures alone; but that mixtures of the two gave very much more than either separately. In two cases the average produce by mixed mineral and nitrogenous manure was more than that by the annual application of farmyard manure; and in nine out of the twelve cases in which such mixtures were used, the average yield per acre was from two to eight bushels more than the average yield of the United Kingdom under ordinary rotation.

Such were the results obtained for forty or fifty years in succession on ordinary arable land. F. S. J.

The Economic Position of the Agriculturist.

Horace Greeley said: "Agriculture is the art of increasing and assuring by human effort and care, the production and growth of such material substances as contribute to the sustenance and enjoyment of our race, either directly or through the nourishment of such animals as minister to the comfort and well-being of mankind."

The origin and progress of agriculture are as the origin and advance of civilization. The rude savage in his wild state may gather nuts, fruits, herbs and roots for his immediate needs. His meat supply depends upon his skill as a marksman or a trapper. He may, in times of plenty, lay up small stores for the approaching time of need, but his supply of nourishment of all kinds is drawn from haphazard nature, and he is certain of nothing.

Far back in prehistoric times when that tribe captured and tamed certain animals, and when, with rude implements, a small piece of ground was prepared and devoted to the occupancy of certain plants, this was the origin of agriculture. That first springtime that he cared for those plants and cared for those animals, this humble-minded human being learned many things. The next season he knew better how to manage his half-wild animals and partially-tamed crops, and his success was better than before. And so he watched and waited and observed and learned. This was the origin of agriculture. This was the beginning of civilization.

The beginning of everything is small and simple. But being thus does not forbid that it shall grow, both in size and complication. From this rude start, centuries ago, has sprung the art and science of agriculture, has sprung the organization of nations as such organization exists today, and the growth and change is not more wonderful than the growth and development of a single plant as we see them every hour if we but look.

The economic position of the agriculturist is what we are to consider at this time. By the term *agriculturist* we are to understand that person who tills the soil with his own hands, or who is directly interested in superintending such work.

The position of the agriculturist among the ancients was not such as to induce much improvement in methods of tilling the soil. The ruling classes wronged themselves and their nations by degrading labor. The Brahminical hierarchy which holds in its grip so large a portion of the human race, ranks the priest above the soldier, and the soldier looks down from an elevated position upon him who tills the soil. This division into caste has *petrified* that race for centuries.

Nearly all of the ancient nations concurred with this fallacious and mistaken estimate, the Hebrews excepted. In the balmy days of Greece her ruling class was a caste of warriors who considered labor degrading. The drudgery of the fields was performed by slaves. In the days of the Roman republic, Italy was a land of cultivators. Each person was allotted a tract of from two to six acres to be cultivated with his own hands, and this was done by the greatest warriors and statesmen. But ere long wars of conquest filled the land with slaves, and rural and domestic labor was performed by the mand came to be considered menial and low. Under this burden of contempt the fair plant withered and agriculture drooped and died. For centuries thereafter, Italy, the natural garden spot of Europe, lay waste, and her population drew their bread from other lands where neither the neglect of the slothful nor the drains of ignorance could impoverish the soil. Upon the rotting fabric of this Roman power was planted Feudalism in the West, and Islamism in the East, and not until the claims of feudalism were somewhat shattered by the Crusades was there a chance for any advance in agricultural methods since the times of Moses and Homer. The serf who tilled the soil while Samson and David still lived was scarcely less efficient than the average serf of western Europe at the time of the Norman Conquest; neither was he less fortunate.

In the days when Grecian thought and reason reached such a high pinnacle, *no* thought was given to agriculture. No! those powerful minds must needs devote themselves to music and art, politics and war. They must invent ways of putting men into slavery or out of the world altogether, rather than devote their thought to methods of feeding hungry mouths and creating comfort and happiness!

Roman thought was more productive in this respect, and more than 2000 years after it was written we still can ponder with profit upon the statements which they have left.

When the Roman Empire was overturned by the Northern Barbarians it fell into hands where war and strength ruled, and where labor was fit only for serfs and slaves. The already rotten and corroded meshes of power in Italy, Greece, Gaul and Iberia became further weakened and polluted and no progress was made.

But the Saracens, those insignificant foreigners so despised in all Europe, what transpired when they entered Southern Europe? They devised plans of irrigation and methods of culture and turned that country from a desert to a garden. The revenue which the Saracens derived from Spain in the tenth century amounted to $30,000,000, which surely indicates a thrift which is unattainable by their successors.

As long as the manacles of feudalism bound the horizon of the European serf, and so long as the thought of civilized countries was devoted to pseudo-philosophic rot, we could expect no progress and we could hardly expect the agriculturist to occupy a position of any economic importance whatsoever. Being held

in check by a fanatical priesthood, being retained or released by a nod of his lord, the tiller of the soil groveled in the lowest strata of ignorance and was more a beast than a man. It was when printing was invented, when America was discovered, and when Martin Luther hewed a pathway for independent thought, that the knell of feudalism was rung and progress in agriculture begun. From that time there has been constant increase and advance.

In England, from the time of Henry VIII there was a constantly increasing interest in agriculture, and the plane of the agriculturist was raised until, instead of the serfdom, it was the nobility, as it is today, who are most interested in agriculture and methods of tillage.

When America was settled agriculture was naturally the leading industry, and the independent and careful thought bestowed at that time to methods of farming bears fruit in the existence of the advanced agriculture of today. From the first the agricultural classes have been important in the political interests of the nation. The fathers of the revolution were all more or less interested in farming.

The high esteem in which the economic importance of the agriculturist is held by some is well shown in the opinions of that school of French economists, the Physiocrats, who affirmed that no value could be created except that which came from the soil. And there was much truth in the statement when this same school said "that the raw material for all manufactures, the subject matter of all trade and transportation, comes originally from the soil."

Then there is the "law of diminishing returns in agriculture," the principle, namely, that after a certain point has been reached the land will not furnish a proportionate increased return to new applications of labor and capital. "This law is so far-reaching and all-embracing," says Francis Walker, "that even the operations of trade and manufacture do not escape its influence. Do you ask then, what is the economic position of the agriculture?

Our government has established, at Washington, a Department of Agriculture. This department expended during the year 1897 the sum of $2,306,365. For what? For the dispensation of knowledge that will be instrumental in enlightening the agriculturist. This work, this expense, shows of what economic importance the agriculturist must be.

Inhabiting the earth are one billion, five hundred million people. Seventy million people are to be found within the limits of the United States. Of these 70,000,000 people more than two-fifths are engaged in husbandry for their living, and more than one-half of the people of the United States are more or less interested in farming. Ninety-three per cent. of the thirty-seven and one-half millions who are to be found in the Gangetic valley and delta, British India, are engaged in agriculture, and the same may be said of many others of the most thickly populated portions of the globe. Thus we may say, I believe without exaggeration, that more than one billion people are engaged in agriculture, while only one-half a billion are engaged in all the other trades and professions.

On beholding the advance made in the arts, many say that the time will be when the land now occupied by farms and gardens may be turned to parks and landscape reservations, and the food for humanity will be furnished by the chemist. The chemist is making great advances, true; he can form some of the simpler compounds from their mineral constituents, but that time is far into the future when the chemist may mix up our proteids and fats with the skill and economy with which they are prepared in Nature's laboratory. And at the end of a thousand years our posterity may expect to see the plowman following the plow

along the steaming furrow. Nature's plenty assured by fields of growing grain, while herds of cattle graze peacefully on hillside and prairie.

J. F. C.

Humus in Its Relation to Soil Fertility.

(Abstract.)

The term humus is applied to a large class of compounds derived from the decay of animal and vegetable life. The animal and vegetable materials undergo decomposition in the soil, the final result of which is a disappearance of these substances, leaving only a few gases and a small amount of mineral matter. When the organic matter is in its intermediate stages of decomposition and mixed with the soil, it is known as humus.

Opinions as to the fertilizing value of humus have swung from one extreme to the other. By early chemists, humus was considered as supplying the larger part of the material for plant growth. But since the work of Liebig and others demonstrated that the greater part of plant food comes from the air, scientists have assigned a low value to humus; but from the earliest times farmers have attached a high value to humus as a factor of soil fertility, their belief being based upon actual observation.

Humus performs a number of different functions in the soil which are of the highest importance. It influences temperature, tilth, permeability, absorption power, weight and color of soils, and directly or indirectly controls the supply of water, nitrogen and phosphoric acid in the soil.

That a virgin soil will be very productive for a number of years, but gradually decline, is a well-known fact based on observation. Extensive experiments have shown us, however, that this decline in fertility is not entirely due to the removal from the soil of the essential fertilizing elements, but is due in many cases to the loss of humus. By experiments carried on at the Minnesota Experiment Station it was shown that the difference between the producing power of new and worn soil was about 15 bushels. It was also shown that this was not due to a lack of mineral food. The most important difference, either physical or chemical, between the composition of old and new soils of the same character was the amount of humus present.

That the loss of humus is an important factor in the decline of fertility is indicated by the fact that by those methods of farming in which grasses form a principal part of the rotation, especially those that leave a large residue of roots and culms, the decline of fertility is much slower than where those crops that leave little residue are grown continually.

Agriculturally considered, the two most important points regarding the composition of humus are (1) the presence of nitrogen as a constant constituent, and (2) the chemical union of humus with potash, lime and phosphoric acid, to form humates.

Nitrogen, being one of the most prominent constituents of humus, and also one of the most important elements in plant growth, it is easy to understand how a loss of humus also results in a loss of that important and most expensive element—nitrogen.

(To be Continued.)

BOOK REVIEWS.

Bird Studies—W. E. D. Scott; pp. 363; Illustrations 164; Cloth; G. P. Putnam's Sons; New York. $5.00.

In this work the author has brought together a unique and useful collection of notes upon general ornithology, and a rare collection of beautiful photographs of birds in their native haunts. The main object of the work appears to be, as the author says in his introduction, "to place before students and others who wish to acquire knowledge on the subject, a means to that end." In the class

of Land Birds, as recognized in this work, is included all birds found in eastern North America, from the song birds to the gallinaceous groups, ending with the common quail.

The general tone of the work is popular rather than scientific, thus making it interesting to all as well as those who have spent much time in the study of ornithology. The author recognizes the fact that by pointing a pleasant way where there seemed to be a narrow and little trodden path, is often to lead a would-be traveler into that way. In this book this is done by making an entirely artificial grouping of the birds rather than a systematic one. From the subjects of some of the chapters it will be seen that for the ordinary person this artificial grouping will answer the purpose better than any grouping that is dependent upon the form and shape of the bird rather than his habits. "About the House," "Along the Highway," "In the Woods," etc., are the heads of some of the chapters. But let it not be understood that no science is brought into the book at all. Each individual is known by his scientific name, and his habits and appearance are discussed in detail from the observations which the author has carried on for many years.

One of the chief charms of the work, however, lies in the illustrations, which are unusually fine. Being made from photographs, they are true to life, and as the material of the book is unusually good, they are fine and clear.

All in all, this book makes very pleasant and profitable reading for anyone, while to the student of ornithology it is a gem. The book itself is a model of the bookmakers' art, and is fit to grace the shelves of any library. It is especially adapted to school and college libraries and where students, young or old, may have access to it. J. F. C.

Nature for Its Own Sake—John C. Van Dyke; Cloth; pp. 292; Charles Scribner's Sons; New York; $1.50.

In this collection of essays the author takes the unusual position of considering nature as simply *Nature,* nothing else. He takes the view that nature is a mere earthly combination of lights, and clouds, and land and water and foliage, animal life having no part whatever in the "nature" of his mind; in short, the nature that may have been before the dawn of animal existence. To many this may seem a cold and barren view of what we commonly term nature, but, without the least bit of human sentiment it is interesting to see how bright the common things about us may become.

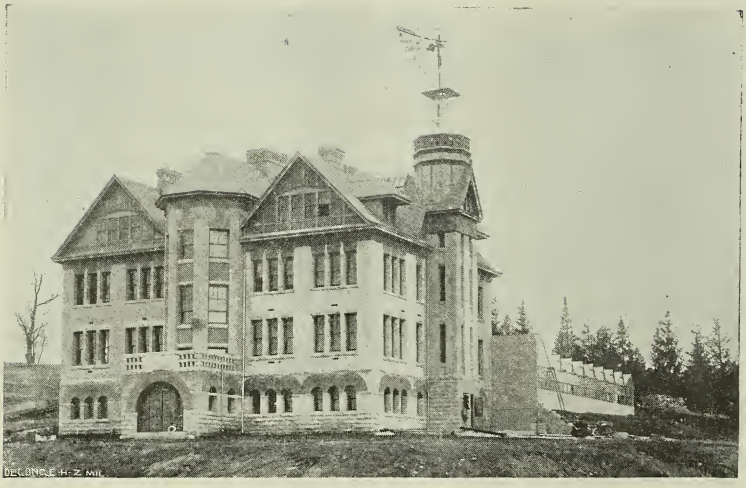
The mission of the book seems to be to call out the beauties in the common things about us, things that we may behold every hour of the day and still which we may never see to appreciate. It aims to give us strength to grasp the meaning and full enjoyment of that right and privilege we inherit which may be had for the trouble of beholding.

Art and any appeal of this lifeless nature to our sentiments is banished from the book entirely and only the sublimity and grandeur of earth and sky is left for the satisfaction of the aesthetic taste. While many beauties are brought out, we cannot help but conclude that the general tone of the essays is scientific and as such are correct, clear and very creditable to the author. Each paragraph is indexed with marginal titles throughout the book, making it handy as a reference for the statements presented.

The essays are written in a clear and swinging manner, and while instructive, are also very bright and interesting. The most notable feature of the book (to the writer at least) is that all the ordinary phenomena of our daily life are fully explained and described. Questions that go unanswered every day are found fully and scientifically explained here.

It is a sound, clear, instructive, interesting and very well written book.

J. F. C.



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